Fisher Controls

Instruction Manual

Caged 249 Series and Type 259B Displacer Sensors

FISHER®

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SCOPE OF MANUAL

This manual describes the caged 249 Series and Type 259B sensors and provides sensor maintenance instructions and parts lists. Although a sensor is usually shipped with attached controller or transmitter, this manual does not include installation, calibration, adjustment, maintenance, or removal instructions for the controller/transmitter or for the complete unit. For this information, refer to the appropriate controller/transmitter instruction manual.

TYPE NUMBER DESCRIPTION

The cage head on all of the following constructions except the Type 259B may be rotated to any of the eight alternate positions shown in figure 6. Connection sizes are either 1-1/2" or 2"; see the "Parts List" section for specific sizes by construction, standard displacer lengths, and standard construction materials.

Type 249—ANSI Class 125 or 250 cast iron cage with screwed or flanged connections.

Type 249B—ANSI Class 150, 300, or 600 steel cage with screwed or flanged connections.

Type 249C—ANSI Class 150, 300, or 600 stainless steel cage with screwed or flanged connections.

Type 249K—ANSI Class 1500 steel cage with flanged connections only.

Type 249L—ANSI Class 2500 steel cage with flanged connections only.

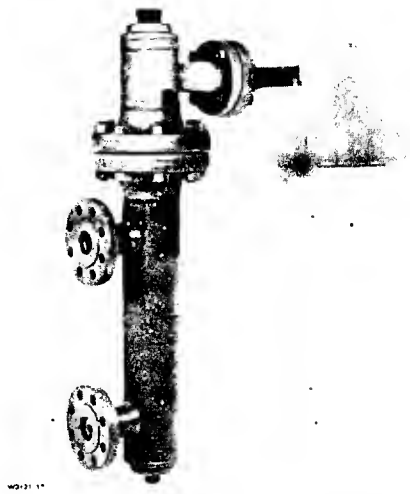


Figure 1. Type 249B Sensor with 2500 Series Controller

Type 249N—ANSI Class 900 steel cage with flanged connections only.

Type 259B—ANSI Class 150, 300, or 600 steel cage with screwed or flanged connections and nonrotatable head. A special version of this type uses a piezometer ring (figure 3) to eliminate velocity effects caused by liquid passing through the displacer cage when it is desired to measure the specific gravity of a liquid in a flowing line, and when the fluid velocity exceeds two feet per minute past the displacer in the cage.

INTRODUCTION

These sensors are designed to measure liquid level, interface level, or specific gravity inside a vessel, or specific gravity of a liquid in a flowing line (special piezometer ring

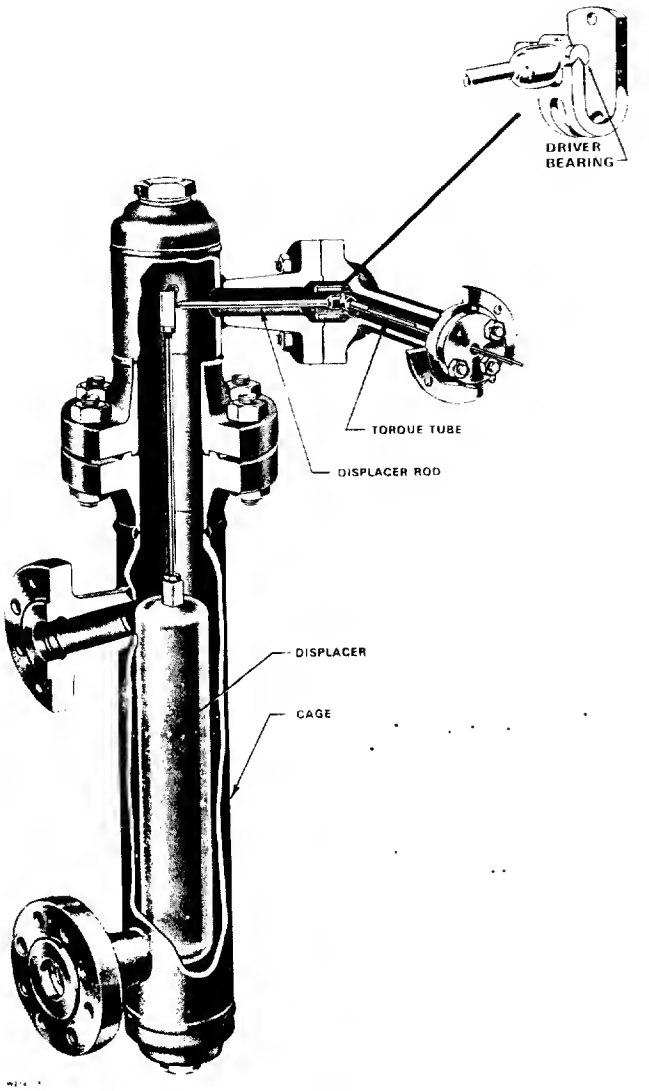


Figure 2. Typical Caged Displacer

construction). Key to the sensor is the torque tube assembly (see figure 2), which consists of a hollow torque tube with a shaft welded inside it at one end and protruding from it at the other end. The unconnected end of the tube is gasketed and clamped rigidly to the torque tube arm, permitting the protruding end of the shaft to twist and therefore transmit rotary motion. This allows the interior of the torque tube to be carried at atmospheric pressure, thus eliminating packing and the disadvantages of packing friction.

The displacer will always exert a downward force on one end of the displacer rod. The other end of the displacer rod rests on a knife-edged driver bearing. A keyed shaft on the bearing end of the displacer fits into a socket on the outside of the welded end of the torque tube assembly.

A change in liquid level, interface level, or specific gravity buoys up the displacer by a force equal to the weight of the

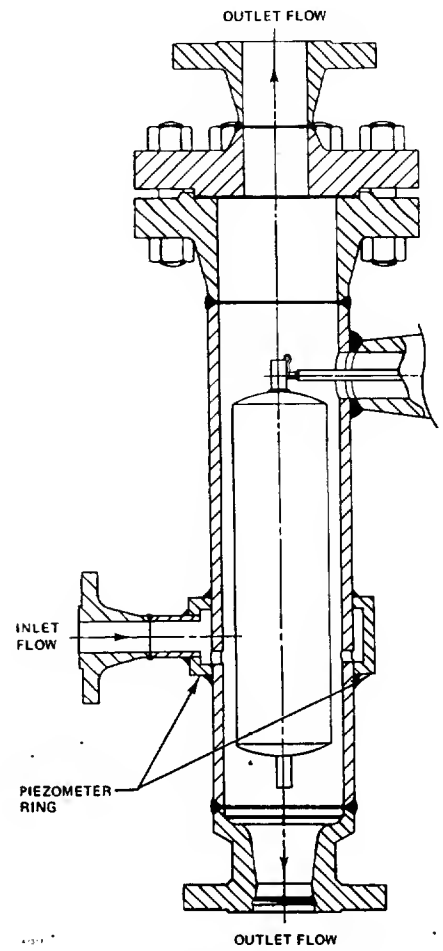


Figure 3. Piezometer-Ring Cage Mounted in Flow Line

liquid displaced. Corresponding vertical movement of the displacer will result in angular movement of the displacer rod around the knife edge. Since the torque tube assembly is a torsional spring which supports the displacer and determines the amount of movement of the displacer rod for a given displacement change, it will twist a specific amount for each increment of buoyancy change. This rotation is brought to the outside of the torque tube arm by the protruding rotary shaft. A controller or transmitter is attached to the end of the rotary shaft to convert the rotary motion into varying pneumatic or electric signals.

MAINTENANCE AND TROUBLESHOOTING

Before attempting disassembly, lower the vessel level below the sensor torque tube arm, or shut off the cage valves and drain the cage. For closed vessels, release all pressure. Shut off any electrical or pneumatic input to the controller or transmitter, and vent any pneumatic supply pressure.

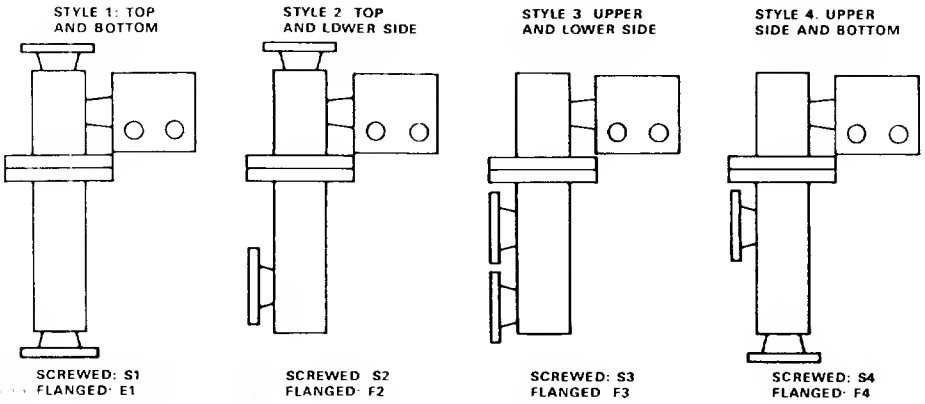


Figure 4. Cage Connection Styles

WARNING

The displacer in this unit is a sealed container and, if penetrated by the process fluid, may retain pressure or hazardous fluid for an extended period. Such a displacer may contain pressure as a result of being in a pressurized vessel, may contain fluid that becomes pressurized due to a change in temperature, and may contain fluid that is hazardous or flammable. Sudden release of pressure, contact with hazardous fluid, fire, or explosion, resulting in personal injury or property damage, can occur if a displacer that is retaining pressure or process fluid is punctured, subjected to heat, or repaired. Handle the displacer with care in removing, storing, or disposing, taking into consideration characteristics of the process fluid.

Note

Except for gaskets, trouble symptoms peculiar to specific parts are discussed in the sections appropriate to these parts. Regardless of location, gasket failure is evidenced by leakage in the gasket area. Every time a gasket is removed, replace it with a new one upon reassembly.

The procedures below apply to all sensor types except where indicated. Key numbers used are shown in the following illustrations: Type 249—figure 8; Type 249B—figure 9; Type 249C—figure 10; Type 249K—figure 11; Type 249L—figure 12; Type 249N—figure 13; Type 259B—figure 14.

Cage

Process residue buildup in the bottom of the cage or at the connections may restrict flow in and out of the cage or interfere with displacer motion.

1. For complete drainage and cleaning of a cage with Style 2 or 3 connections (see figure 4), remove the pipe plug (key 17 or 26) from the bottom of the cage. Remove the liquid damper (key 29) if desired.

2. A Style 1 or 4 cage must be disconnected at the lower connection and the liquid damper removed. Remove the damper by prying it out of a flanged connection or by unscrewing it from a screwed connection with a 1/2-inch hex (Allen) wrench.

3. On a piezometer-ring cage, there are six pipe plugs around the ring that may be removed if plugging is a problem. Each plug lines up with a 1/4-inch-diameter hole drilled through the cage.

Displacer Rod Connection

The cotter springs (key 11), the ball on the displacer rod (key 7), and the stem end piece (key 23) or displacer spud socket may be either too worn for a secure connection, or so clogged or corroded that the displacer does not pivot properly.

1. Access to the cotter springs, displacer rod ball, stem end piece, or displacer spud is gained as follows:

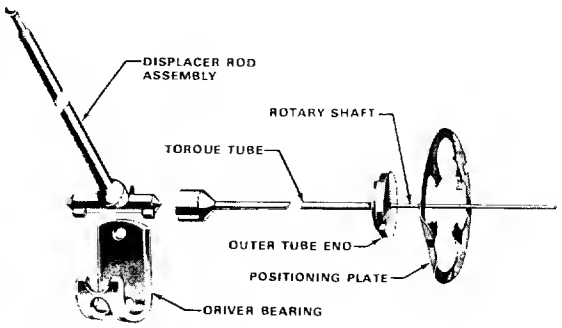
- **All Type 259B Sensors**—by removing the hex nuts (key 22), flange (key 28), and gasket (key 12).

- **All Other Sensors with Style 1 or 2 Connections**—through the top connection.

- **Type 249L Sensors with Style 3 or 4 Connections**—by removing the hex nuts (key 33), flange (key 30), and ring (key 31).

- **All Other Sensors with Style 3 or 4 Connections**—by removing the top pipe plug (key 26).

REMOVAL OR INSTALLATION OF POSITIONING PLATE



EXPLODED VIEW OF TORQUE TUBE AND DISPLACER ROD ASSEMBLY

Figure 5. Torque Tube and Displacer Rod Assemblies

Torque Tube

Corrosion or leakage through the outer end is evidence of deterioration in the torque tube assembly (key 9) or torque tube end gasket (key 14). Erratic or nonexistent rotary shaft output may occur if the socket on the inner end of the torque tube assembly does not engage the bearing end of the displacer rod assembly (key 7).

1. If the controller or transmitter is still mounted on the torque tube arm, remove it according to the instructions in the appropriate controller/transmitter manual.

2. Remove the nuts (key 18) and retaining flange (key 6).

CAUTION

If the displacer is still attached to the displacer rod at this point, be careful not to let the torque tube assembly slip when using the screwdriver leverage procedure in steps 3 and 5. Sudden release of the displacer could cause damage.

3. Remove the positioning plate (key 8) by freeing its two lugs. The vertical lug fits into a hole in the flange of the torque tube arm (top of figure 5). The horizontal lug (hidden behind the screwdriver at the bottom of figure 5) fits into a slot in the outer tube end of the torque tube assembly (the figure 5 exploded view shows this lug to the right of the outer tube end). The positioning plate may be pried away from the torque tube arm and outer tube end if the displacer already has been disconnected from the displacer rod. However, if the displacer is still connected to the displacer rod, place a screwdriver blade in the slots of the positioning plate and outer tube end as shown in figure 5. Slowly turn the positioning plate to release its lug from the torque tube arm. Then carefully turn the plate back to allow the displacer to come to rest, and slip the other lug of the plate from its slot in the outer tube end.

4. Pull the torque tube assembly and tube end gasket out of the torque tube arm.

5. Install a new tube end gasket and insert the torque tube assembly into the torque tube arm as shown in figure 5. Rotate the torque tube assembly until its socket mates with the driver member on the displacer rod assembly and so that the outer tube flange rests against the gasket. With a thumb on the upper portion of the positioning plate and a screwdriver in the slots as shown in figure 5, rotate the plate and press the lug on the plate into the hole in the torque tube arm.

6. Install the retaining flange and secure it with four nuts (key 18), being sure to tighten all of the nuts evenly.

Changing Cage Head Position

Except on the Type 259B, the cage head (key 2) may be mounted so that the torque tube arm (key 3) is in any one of eight alternate positions around the cage as shown in figure 6. Neither the displacer nor the torque tube arm need be removed when head position is changed. Remove the hex nuts (key 22, or key 20 for a Class 125 Type 249) from the bolting (key 21), and reposition the head as desired.

Temperature-Compensated Displacer

A special displacer (see figure 7) may be supplied for specific gravity applications where the effects of temperature change on the value of specific gravity cannot be tolerated. This displacer is filled with the liquid being measured or one with an equal coefficient of expansion. In service, it will expand and contract the same amount as the measured liquid and nullify any signal change that may be due to a change in temperature.

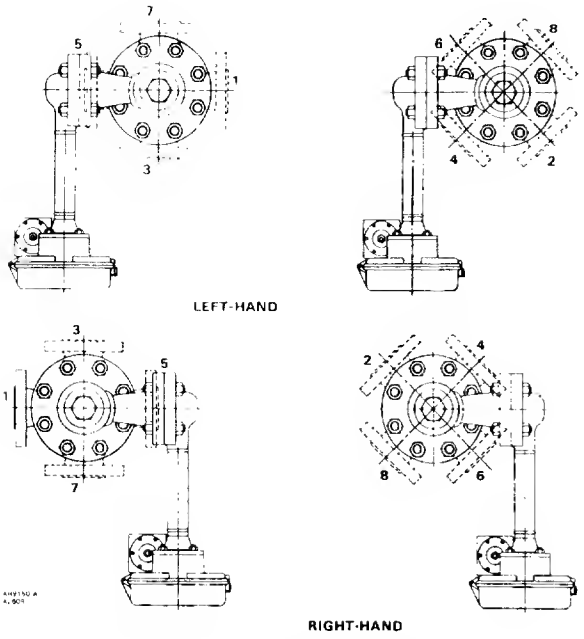


Figure 6. Cage Head Mounting Positions

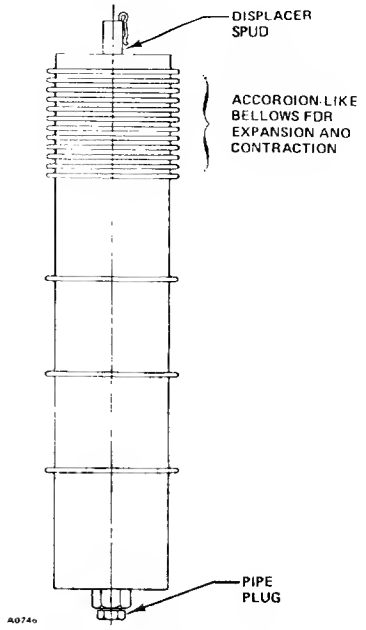


Figure 7. Temperature-Compensated Displacer

When shipped with a complete **Level-Trol®** controller/transmitter assembly, this displacer will be shipped in a separate carton but will be crated with the rest of the assembly. In order to install the displacer, the cage head or top flange must be removed according to step 1 of the "Displacer and Stem" section. Before the displacer is installed in the cage, it must be filled with the liquid that is being measured (or one with an equal coefficient of expansion and at least the process gravity). If the process liquid is corrosive so that a gas will evolve from the corrosion process, a substitute liquid must be used. Extreme care must be taken in filling the displacer to eliminate all air or gas.

To fill, remove the pipe plug and fill through this opening. The displacer is very flexible and will elongate as the weight of the liquid in it increases. Fill until the length is that specified in the order and that required for the installation. Then replace the pipe plug and rotate and invert the displacer a few times to allow any trapped air or gas bubbles to rise to the surface of the liquid. Remove the pipe plug again and let this trapped air or gas escape, and then fill completely with the liquid.

CAUTION

Do not allow any air or gas bubbles to remain in the liquid. If bubbles remain, the displacer becomes sensitive to pressure changes in the cage or vessel, causing errors in controller or transmitter output signal and possible damage to the displacer. The weight of the displacer after filling must be such that it will sink in the liquid of the maximum specific gravity to be encountered.

With all air bubbles removed and the plug tightened, the displacer will remain at the desired length until it expands or contracts to compensate for temperature changes in service.

Displacer and Stem

If the displacer (key 10) bottoms, appears to be overweight, or causes output drift, it may have been penetrated by the process fluid.

Process residue buildup on the displacer and stem (key 24) may change displacer weight or displacement. A bent stem or a dented or corroded displacer can impair performance.

Note

Except on a Type 259B, the displacer may remain attached to the displacer rod and be lifted out with the cage head (key 2) when the latter is removed. If separating the displacer and displacer rod before removing the cage head, remove the cotter springs (key 11) according to the "Displacer Rod Connection" section. Be careful not to let the displacer slip and drop into the bottom of the cage, as displacer damage could result.

1. Remove the hex nuts (key 20 or 22) and bolting (key 21). Lift off the flange (key 28), or cage head and attached parts. If the displacer comes out with the cage head, be careful not to damage the displacer or bend the stem when setting the cage head down. Replace displacer and associated parts as necessary.

Torque Tube Arm (Including Change of Mounting Method)

Looseness of the driver bearing (key 4), wear on its knife-edged surface, or a bent, worn, or corroded displacer rod assembly (key 7) may impair performance. Be especially sure to check the ball on the displacer rod.

1. Remove the displacer, if it has not already been removed, according to the "Displacer Rod Connection" and "Displacer and Stem" sections.

2. If the controller or transmitter is still mounted on the torque tube arm, remove it according to the instructions in the appropriate controller/transmitter manual.

3. Remove the torque tube assembly (key 9) according to the "Torque Tube" section.

4. Remove the bolting (keys 19 and 20), torque tube arm, and arm gasket (key 13).

5. Remove the bearing bolts (key 5), displacer rod assembly, and driver bearing.

Note

Be sure that the driver bearing will be installed so that its knife edge is pointing up when the torque tube arm is mounted in the desired orientation (figure 6). Since changing the mounting position of the torque tube arm by 180° will change controller or transmitter action from direct to reverse or vice versa, it will be necessary to reverse controller/transmitter action from what it was before the mounting method was changed.

6. Install the driver bearing, displacer rod assembly, and bearing bolts (key 5) into the torque tube arm. Install a new arm gasket. Install the torque tube arm in the desired mounting position on the cage head (the cage itself on the Type 259B) and secure it with the bolting (keys 19 and 20).

7. Install the torque tube assembly according to the "Torque Tube" section.

8. Install the controller or transmitter on the torque tube arm according to the instructions in the appropriate controller/transmitter manual.

9. Install the displacer according to the "Displacer and Stem" and "Displacer Rod Connection" sections.

PARTS ORDERING

Each sensor is assigned a serial number which is stamped on a nameplate (key 54, not shown) attached to the torque tube arm. This same number also appears on the controller/transmitter nameplate when a complete controller/transmitter-sensor unit is shipped from the factory. Refer to the number when contacting your Fisher representative for technical assistance, or when ordering replacement parts.

When ordering a replacement part, be sure to include the 11-character part number from the following parts list. Parts with standard materials are included for all standard constructions listed in the "Type Number Description" section.

PARTS LIST

Type 249 (figure 8)

Key	Description	Part Number
1	Cage (w/o gauge bosses), cast iron	
	14" displacer length	
	Class 125	
	S1 connection, 1-1/2" NPT	1N4085 19012
	S1 connection, 2" NPT	1N4423 19012
	F1 connection, 2"	1N4149 19012
	Class 250	
	S1 connection, 1-1/2" NPT	1N4089 19022
	S1 connection, 2" NPT	1N4150 19022
	F1 connection, 2"	1N4095 19022
	S2, S3, & S4 connections, 1-1/2" NPT	2N4168 19022
	S2, S3, & S4 connections, 2" NPT	2N4167 19022
	32" displacer length	
	Class 125	
	S1 connection, 1-1/2" NPT	1N4087 19012
	S1 connection, 2" NPT	1N4160 19012
	F1 connection, 2"	1N4088 19012
	Class 250	
	S1 connection, 1-1/2" NPT	1N4091 19022
	S1 connection, 2" NPT	1N4084 19022
	F1 connection, 2"	1N4155 19012
2	Cage Head, cast iron	
	Class 125	
	S1 connection, 1-1/2" NPT	1N3958 19012
	S1 connection, 2" NPT	1N3980 19012
	F1 connection, 2"	1N4158 19012
	Class 250	
	All screwed 1-1/2" NPT connections	1N3972 19022
	S1 and S2 connections, 2" NPT	1N3965 19022
	F1 connection, 2"	1N3974 19022

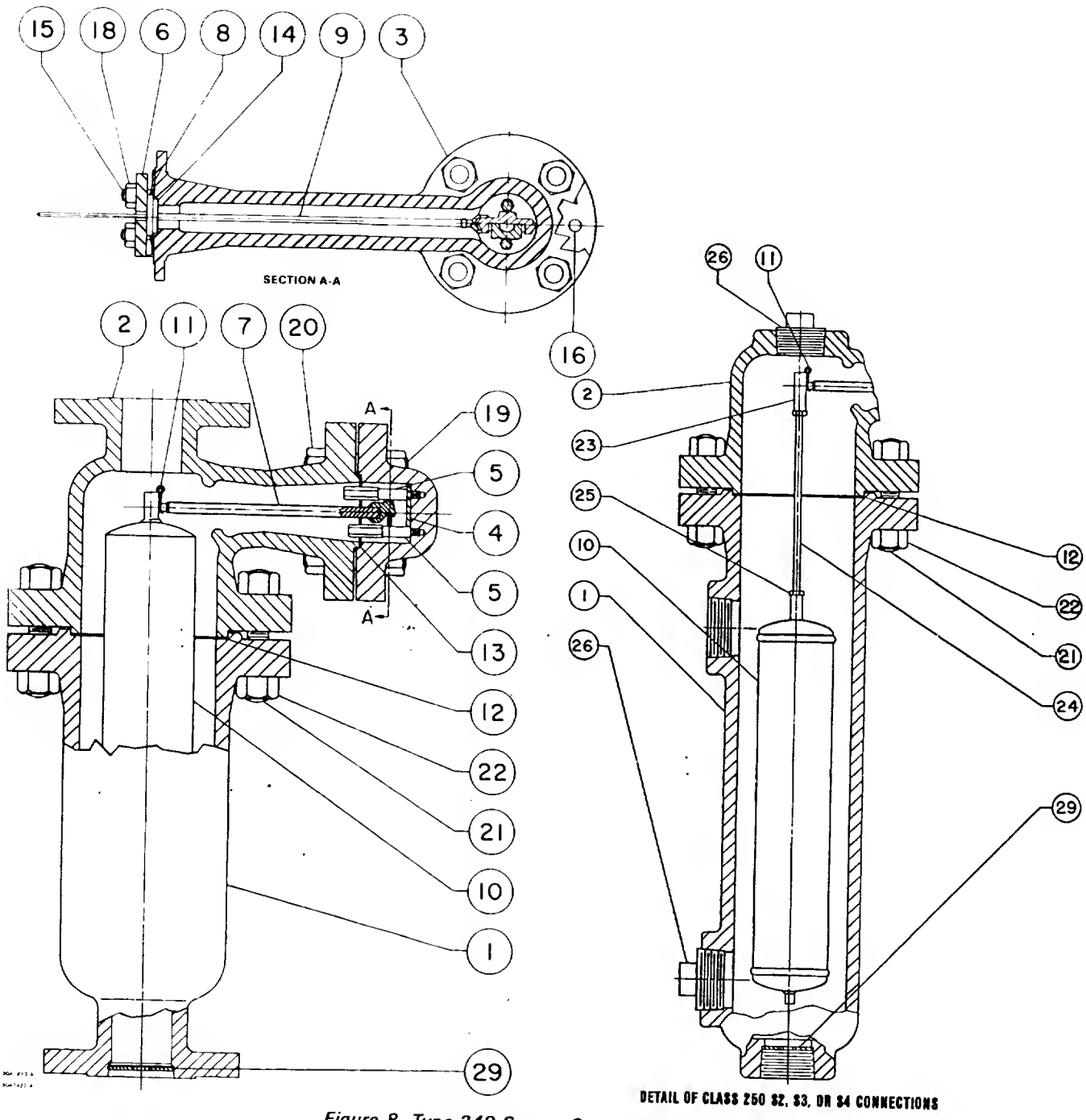


Figure 8. Type 249 Sensor Constructions

Key	Description	Part Number
3	Torque Tube Arm, cast iron	
	Class 125	3B5311 19012
	Class 250	3B5313 19022
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	1B5320 25032
7	Rod & Driver Ass'y., 316 SST	1B5461 000A2
8	Positioning Plate, steel, Cd pl	1B8123 25082
9*	Torque Tube Ass'y., K-Monel†	
	Std wall	1K4493 000A2
	Thin wall	1K4495 000A2
	Heavy wall	1K4497 000A2
10	Displacer, 304 SST	
	3" x 14"	15A3848 X172
	2" x 32"	15A4586 X012
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, asbestos	
	Class 125	0Y0944 04022
	Class 250	0Y0945 04022

*Recommended spare part.
† Trademark of International Nickel Co.

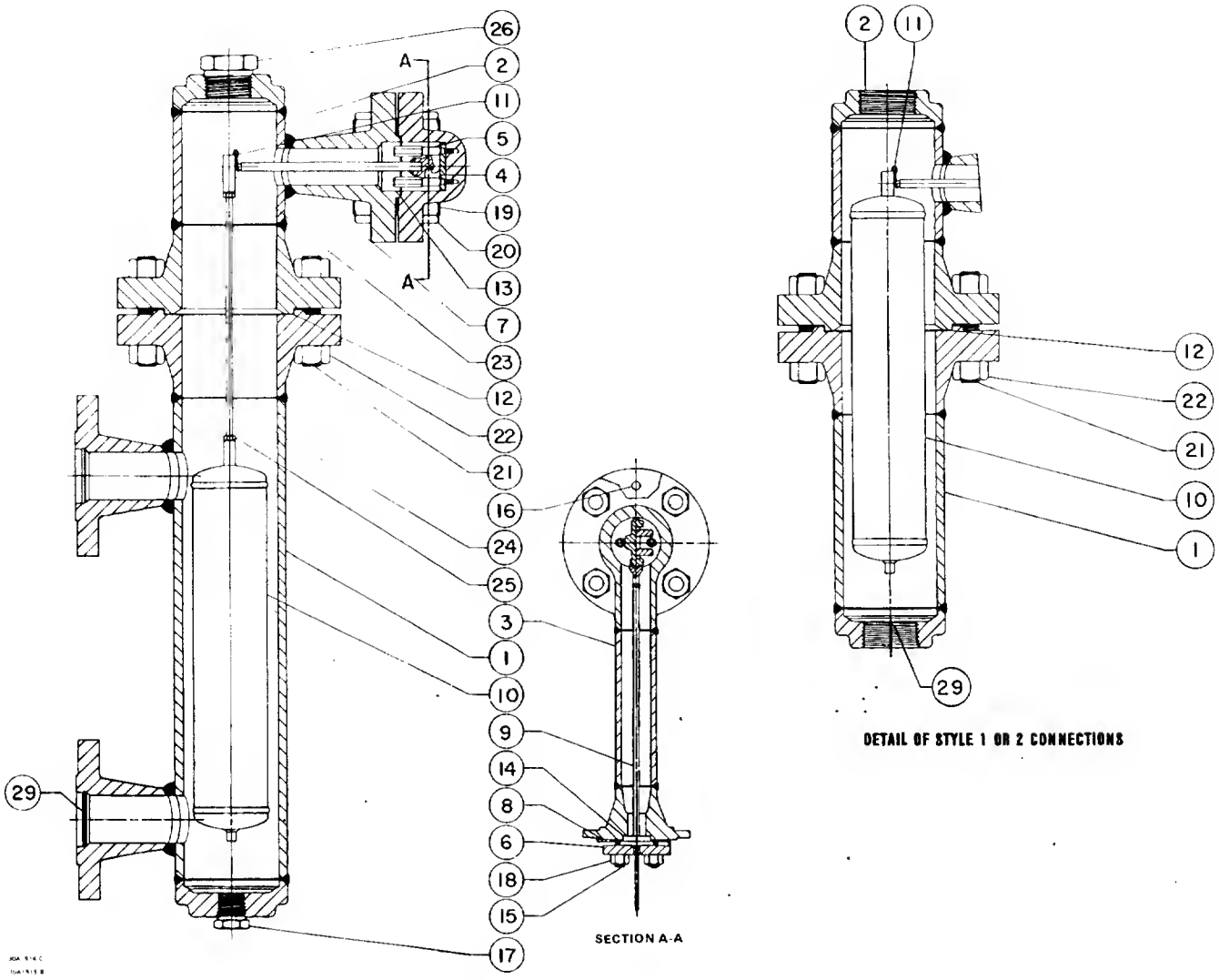


Figure 9. Type 249B Sensor Constructions

Key	Description	Part Number
13*	Arm Gasket, Asbestos	1E5629 04022
14*	Torque Tube End Gasket, 316 SST & Asbestos	1B1316 99222
15	Stud Bolt, steel (4 req'd)	1A3310 31012
16	Groove Pin, steel, Zn pl	1A3618 28992
18	Hex Nut, steel (4 req'd)	1A3773 24072
19	Cap Screw, steel (4 req'd)	
	Class 125	1A5147 X0022
	Class 250	1A9362 X0022
20	Hex Nut, steel	
	Class 125 (12 req'd)	1A3772 24072
	Class 250 (4 req'd)	1A3433 24232
21	Cap Screw, steel (8 req'd)	
	Class 125	1A3615 X0022
	Class 250	1A3534 X0012
22	Hex Nut (Class 250 only), steel, Cd pl (8 req'd)	1A3681 24112
23	Stem End Piece (Class 250 S2, S3, & S4 connections only), 316 SST	1A3933 35072
24	Displacer Stem (Class 250 S2, S3, & S4 connections only), 316 SST	1E7845 35072
25	Hex Nut (Class 250 S2, S3, & S4 connections only), 316 SST (2 req'd)	1A3915 35252
26	Pipe Plug (Class 250 only), malleable iron	
	1-1/2" NPT S2, S3 & S4 connections (2 req'd) or 2" NPT S3 & S4 connections (1 req'd)	1A3916 21992
	2" NPT S2 connections (2 req'd) or 2" NPT S3 & S4 connections (1 req'd)	1A9234 19012
29	Liquid Damper, 316 SST	
	1-1/2" connections	1N2088 36022
	2" connections	1N2089 36022
54	Nameplate (not shown), 18-8 SST	23A1725 X012
55	Drive Screw (not shown), 18-8 SST (4 req'd)	1A3682 28982

Type 249B (figure 9)

1	Cage (w/o gauge bosses), Steel	See following table
2	Cage Head, steel	
	S1 & S2 connections	
	1-1/2" NPT	1N2271 000A2
	2" NPT	1N2270 000A2
	F1 & F2 connections	
	1-1/2" Class 150	1H5263 000A2
	1-1/2" Class 300	1J8803 000A2
	2" Class 150	1E8037 000A2
	2" Class 300	1E8036 000A2
	2" Class 600	1E8025 26032
	All style 3 & 4 connections	1N2271 000A2

*Recommended spare part.

Key 1 Type 249B Cage, Steel

CONNECTION STYLE	SIZE AND RATING	DISPLACER LENGTH					
		14"	32"	48"	60"	72"	84"
S1	1-1/2" NPT	1L9719 000A2	1N1722 26032	1N1883 000A2	1N2144 X0012	1N2054 X0012	1N2179 X0012
	2" NPT	1L9739 000A2	1N1736 X0012	1N1884 000A2	1N2145 X0012	1N2055 X0012	1N2180 X0012
F1	1-1/2" Class 150	1N2468 000A2	1N2762 26032	1N2793 26032	1L6539 X0012	1N2826 X0012	1L6540 X0012
	1-1/2" Class 300	1N2728 26032	1N2763 26032	1N2794 X0012	1L6546 000A2	1N2827 000A2	1L6547 X0012
	2" Class 150	1N2729 26032	1N2764 26032	1N2795 X0012	1N2811 26032	1N2888 000A2	1L6549 X0012
	2" Class 300	1N2730 26032	1N2765 000A2	1N2796 000A2	1N2812 26032	1N2889 X0012	1N2903 X0012
	2" Class 600	1N2732 000A2	1N2767 26032	1N2797 X0012	1N2813 X0012	1N2890 X0012	1L6552 X0012
S2	1-1/2" NPT	1N1791 000A2	1N1744 000A2	1N1890 000A2	1N2151 26032	1N2061 000A2	1N2182 X0012
	2" NPT	1N1792 26032	1N1745 000A2	1N1891 26032	1N2152 X0012	1N2062 X0012	1L7024 X0012
F2	1-1/2" Class 150	1L9741 000A2	1N1737 26032	1N1885 26032	1N2146 000A2	1N2056 26032	1L6554 000A2
	1-1/2" Class 300	1L3861 000A2	1N1738 000A2	1N1886 26032	1N2147 26032	1N2057 X0012	1L6557 X0012
	2" Class 150	1L9751 000A2	1N1739 26032	1N1887 000A2	1N2148 26032	1N2058 X0012	1L6559 X0012
	2" Class 300	1L9752 000A2	1N1740 000A2	1N1888 26032	1N2149 000A2	1N2059 000A2	1N2181 000A2
	2" Class 600	1N1789 000A2	1N1742 26032	1N1889 X0012	1N2150 000A2	1N2060 X0012	1L6563 X0012
S3	1-1/2" NPT	1N1800 000A2	1N1753 000A2	1N1896 X0012	1N2165 26032	1N2068 X0012	1N2186 X0012
	2" NPT	1N1801 26032	1N1754 26032	1N1897 26032	1N2166 X0012	1N2069 26032	1N2187 X0012
F3	1-1/2" Class 150	1N1793 000A2	1N1746 000A2	1N1892 26032	1N2153 000A2	1N2063 X0012	1L6566 000A2
	1-1/2" Class 300	1N1794 000A2	1N1747 26032	1N1893 26032	1L6570 000A2	1N2064 X0012	1N2183 26032
	2" Class 150	1N1795 000A2	1N1748 000A2	1N1894 26032	1N2154 26032	1N2065 000A2	1N2184 000A2
	2" Class 300	1N1796 000A2	1N1750 000A2	1N1895 26032	1N2155 000A2	1N2066 000A2	1N2185 X0012
	2" Class 600	1N1798 000A2	1N1751 000A2	1N2037 000A2	1N2156 000A2	1N2067 000A2	1L6573 X0012
S4	1-1/2" NPT	1N1802 000A2	1N1755 26032	1N1898 000A2	1N2167 X0012	1N2070 X0012	1N2188 X0012
	2" NPT	1N1803 26032	1N1756 26032	1N1899 26032	1N2168 X0012	1N2071 X0012	1N2189 X0012
F4	1-1/2" Class 150	1N2734 26032	1N2771 000A2	1N2798 26032	1N2814 26032	1N2891 000A2	1N2904 X0012
	1-1/2" Class 300	1N2735 26032	1N2772 26032	1L7081 26032	1N2815 X0012	1N2892 26032	1L7082 X0012
	2" Class 150	1N2736 26032	1N2773 000A2	1N2799 000A2	1N2816 26032	1N2893 X0012	1N2905 X0012
	2" Class 300	1N2737 000A2	1N2774 26032	1N2800 000A2	1N2817 X0012	1N2894 000A2	1N2906 X0012
	2" Class 600	1N2739 000A2	1N2776 X0012	1N2801 X0012	1N2818 26032	1N2895 X0012	1L7083 26032

Key	Description	Part Number
3	Torque Tube Arm, Steel	3C8183 000A2
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	1B5320 25032
7	Rod & Driver Ass'y., 316 SST	1B5461 000A2
8	Positioning Plate, steel, Cd pl	1B8123 25082
9*	Torque Tube Ass'y., K-Monel	
	Std wall	1K4493 000A2
	Thin wall	1K4495 000A2
	Heavy wall	1K4497 000A2
10	Displacer, 304 SST	
	3" x 14"	15A3848 X172
	2" x 32"	15A4586 X012
	1-5/8" x 48"	15A5007 X022
	1-1/2" x 60"	15A5017 X042
	1-3/8" x 72"	1C1685 000A2
	1-1/4" x 84"	15A5104 X042
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, Asbestos	0Y0873 04022
13*	Arm Gasket, Asbestos	1E5629 04022

Key	Description	Part Number
14*	Torque Tube End Gasket, 316 SST & Asbestos	1B1316 99222
15	Stud Bolt, steel (4 req'd)	1A3310 31012
16	Groove Pin, steel, Zn pl	1A3618 28992
17	Pipe Plug (styles 2 & 3 only), Steel	1A7715 28992
18	Hex Nut, steel (4 req'd)	1A3773 24072
19	Bolt Stud, steel (4 req'd)	1A3544 31012
20	Hex Nut, steel (8 req'd)	1A3760 24072
21	Bolt Stud, steel (8 req'd)	1A3543 31012
22	Hex Nut, steel (16 req'd)	1A3520 24072
23	Stem End Piece (styles 3 & 4 only), 316 SST	1A3933 35072
24	Displacer Stem (styles 3 & 4 only), 316 SST	1E7488 35072
25	Hex Nut (styles 3 & 4 only), 316 SST (2 req'd)	1A3915 35252
26	Pipe Plug (styles 3 & 4 only), Steel	1A3985 24182
29	Liquid Damper, 316 SST	
	1-1/2" NPT or 1-1/2" & 2" flanged connections	1N2088 36022
	2" NPT connections	1N2089 36022

Key	Description	Part Number
54	Nameplate (not shown) 18-8 SST	23A1724 X012
55	Drive Screw (not shown), 18-8 SST (3 req'd)	1A3682 28982

Type 249C (figure 10)

1	Cage, 316 SST	See following table
2	Cage Head, 316 SST	
	Screwed end F3 & F4 connections, 1-1/2"	2F9560 33092
	All S1 & S2 connections, 2" NPT	2J7656 33092
	All F1 & F2 connections	
	1-1/2" Class 150	2F9561 33092
	1-1/2" Class 300	2F9562 33092
	1-1/2" Class 600	2F9563 33092
	2" Class 150	2H59B2 33092
	2" Class 300	2N1342 33092
3	Torque Tube Arm, 316 SST	3B5309 33092
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	1B5320 25032

*Recommended spare part.

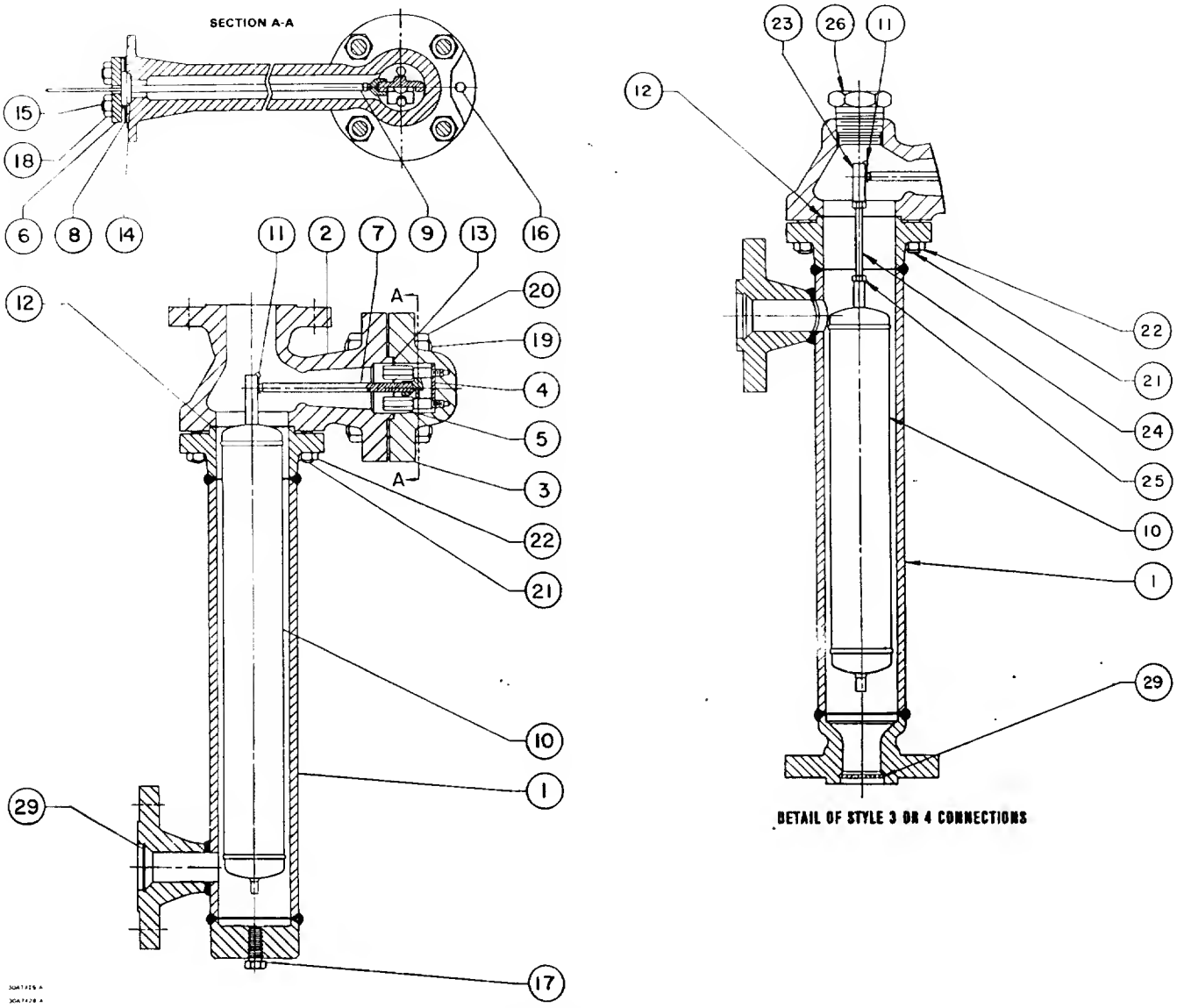


Figure 10. Type 249C Sensor Constructions

Key	Description	Part Number
7	Rod & Driver Ass'y., 316 SST	
	For std wall torque tube	1F9579 000A2
	For heavy wall torque tube	1J8281 X0012
8	Positioning Plate, steel, Cd pl	1B8123 25082
9*	Torque Tube Ass'y., 316 SST	
	Std wall	1K4505 000A2
	Heavy wall	1K4503 000A2
10	Displacer, 316 SST	
	2-3/8" x 14"	15A4547 X052
	1-1/2" x 32"	15A4556 X022
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, Asbestos	1F8305 04022
13*	Arm Gasket, Asbestos	1E5629 04022
14*	Torque Tube End Gasket, 316 SST & Asbestos	181316 99222
15	Stud Bolt, steel (4 req'd)	1A3310 31012
16	Groove pin, steel, Zn pl	1A3618 28992
17	Pipe Plug (styles 2 & 3 only), 316 SST	1A3692 35072
18	Hex Nut, steel (4 req'd)	1A3773 24072
19	Bolt Stud, steel (4 req'd)	1A3544 31012
20	Hex Nut, steel (8 req'd)	1A3760 24072
21	Stud Bolt, steel (8 req'd)	1A8835 31012
22	Hex Nut, steel (8 req'd)	1A3374 24072
23	Stem End Piece (styles 3 & 4 only), 316 SST	1A3933 35072
24	Displacer Stem (styles 3 & 4 only), 316 SST	1N3635 35072
25	Hex Nut (styles 3 & 4 only), 316 SST (2 req'd)	1A3915 35252
26	Pipe Plug (styles 3 & 4 only), 316 SST	1A3985 35072
29	Liquid Damper, 316 SST	
	1-1/2" NPT or 1-1/2" & 2" flanged connections	1N2088 36022
	2" NPT connection	1N2089 36022
54	Nemeplate (not shown) 18-8 SST	23A1725 X012
55	Drive Screw (not shown), 18-8 SST (4 req'd)	1A3682 28982

*Recommended spare part.

Key 1 Type 249C Cage, 316 SST

CONNECTION STYLE	SIZE AND RATING	DISPLACER LENGTH		CONNECTION STYLE	SIZE AND RATING	DISPLACER LENGTH	
		14"	32"			14"	32"
S1	1-1/2" NPT 2" NPT	1N3237 X0012 1N3238 X0012	1N3239 X0012 1N3240 X0012	S3	1-1/2" NPT 2" NPT	1N3235 X0012 1N3236 X0012	1L9236 X0012 1L9237 X0012
F1	1-1/2" Class 150 1-1/2" Class 300 1-1/2" Class 600	1N3199 000A2 1N3200 X0012 1N3201 X0012	1N3203 000A2 1N3204 X0012 1N3205 X0012	F3	1-1/2" Class 150 1-1/2" Class 300 1-1/2" Class 600	1N3217 000A2 1N3218 X0012 1N3219 X0012	1N3222 X0012 1N3223 X0012 1N3224 X0012
	2" Class 150 2" Class 300	1N3202 X0012 1P3693 X0012	1N3206 X0012 1P9860 X0012		2" Class 150 2" Class 300	1N3220 X0012 1N3221 X0012	1N3225 X0012 1N3226 X0012
S2	1-1/2" NPT 2" NPT	1N3241 X0012 1N3242 X0012	1N3243 X0012 1N3244 X0012	S4	1-1/2" NPT 2" NPT	1N3245 X0012 1N3246 X0012	1N3247 X0012 1N3248 X0012
F2	1-1/2" Class 150 1-1/2" Class 300 1-1/2" Class 600	1N3207 000A2 1N3208 X0012 1N3209 X0012	1N3212 X0012 1N3213 X0012 1N3214 X0012	F4	1-1/2" Class 150 1-1/2" Class 300 1-1/2" Class 600	1N3227 X0012 1N3228 X0012 1N3229 X0012	1N3231 X0012 1N3232 X0012 1N3233 X0012
	2" Class 150 2" Class 300	1N3210 X0012 1N3211 X0012	1N3215 X0012 1N3216 X0012		1-1/2" NPT 2" NPT	1N3230 X0012 1P4950 X0012	1N3234 X0012 1R5562 X0012

Key	Description	Part Number
	249K (figure 11)	
1	Cage, steel	
	14" displacer length	
	F1 connection, 1-1/2"	1N9220 X0012
	F1 connection, 2"	1N9222 26032
	F2 connection, 1-1/2"	1N9224 26032
	F2 connection, 2"	1N9226 26032
	F3 connection, 1-1/2"	1N9228 26032
	F3 connection, 2"	1N9230 X0012
	F4 connection, 1-1/2"	1N9232 26032
	F4 connection, 2"	1N9234 26032
	32" displacer length	
	F1 connection, 1-1/2"	1N9221 X0012
	F1 connection, 2"	1N9223 X0012
	F2 connection, 1-1/2"	1N9225 26032
	F2 connection, 2"	1N9227 26032
	F3 connection, 1-1/2"	1N9229 26032
	F3 connection, 2"	1N9231 X0012
	F4 connection, 1-1/2"	1N9233 26032
	F2 connection, 2"	1N9235 26032
2	Cage Head, steel	
	F1 & F2 connections, 1-1/2"	3N9236 22012
	F1 & F2 connections, 2"	3N9237 22012
	F3 & F4 connections, all sizes	3N9238 22012
3	Torque Tube Arm, Steel	3N9239 22012
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072

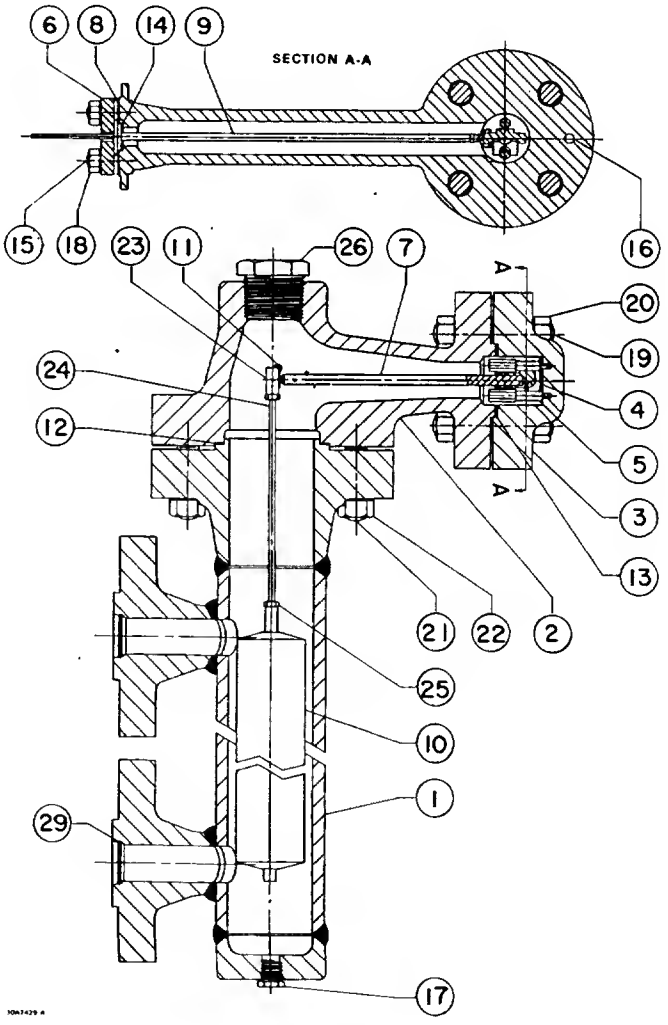


Figure 11. Type 249K Sensor Construction

Caged 249 Series & 259B

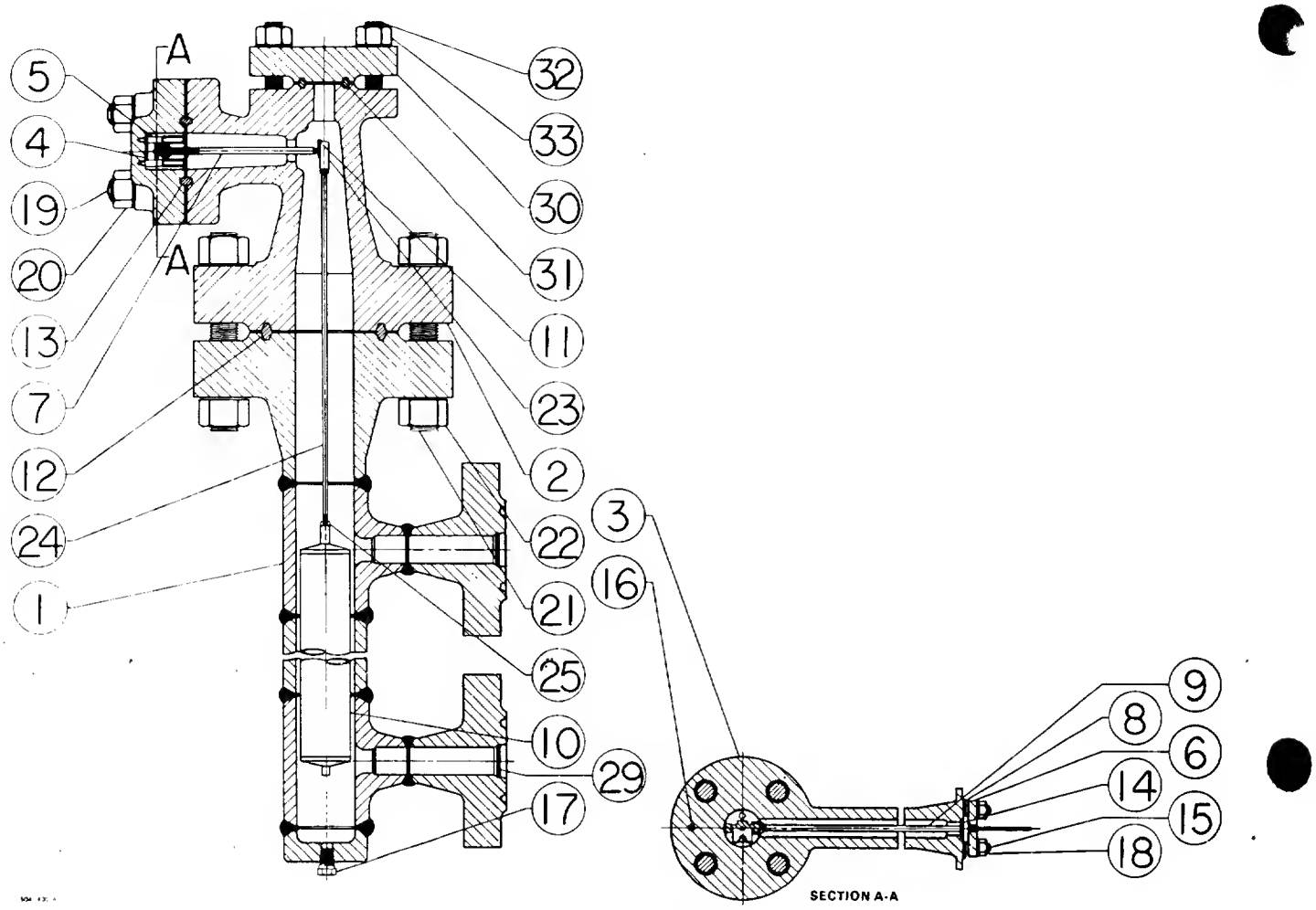


Figure 12. Type 249L Sensor Construction

Key	Description	Part Number
6	Retaining Flange, Steel	1B5321 25032
7	Rod & Driver Ass'y., 316 SST	1C6151 000A2
8	Positioning Plate, steel, Cd pl	1BB123 25082
9*	Torque Tube Ass'y., K-Monel	
	Std wall	1K4499 000A2
	Thin wall	1K4501 000A2
10	Displacer, 304 SST	
	2-3/4" x 14"	1L7548 000A2
	1-3/4" x 32"	15A4666 X032
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, asbestos & SST	1N9242 99152
13*	Arm Gasket, asbestos & SST	1N9243 99152
14*	Torque Tube End Gasket, 316 SST & Asbestos	181316 99222
15	Stud Bolt, steel (4 req'd)	1K6235 X0022
16	Groove Pin, steel, Zn pl	1A3816 28992
17	Pipe Plug (styles 2 & 3 only), Steel	1A3692 24092
18	Hex Nut, steel (4 req'd)	1A3772 24072
19	Stud Bolt, steel (4 req'd)	1A3771 31012
20	Hex Nut, steel (8 req'd)	1C1727 24082
21	8olt Stud, steel (8 req'd)	1A3656 31012
22	Hex Nut, steel (B req'd)	1A4409 24072
23	Stem End Piece (styles 3 & 4 only), 316 SST	1A3933 35072
24	Displacer Stem (styles 3 & 4 only), 316 SST	1L9162 35072
25	Hex Nut (styles 3 & 4 only), 316 SST (2 req'd)	1A3915 35252
26	Pipe Plug (styles 3 & 4 only), Steel	1A4442 28992
29	Liquid Damper, 316 SST	1N2088 36022
54	Nameplate (not shown), 18-8 SST	23A1725 X012
55	Drive Screw (not shown), 18-8 SST (4 req'd)	1A3682 28982

Type 249L (figure 12)

Key	Description	Part Number
1	Cage Ass'y. (2" RTJ), steel	
	14" displacer length	
	F1 connection	1P6429 X0012
	F2 connection	1P6438 X0012
	F3 connection	1P6435 X0012
	F4 connection	1P6561 X0012
	32" displacer length	
	F1 connection	1P6430 X0012
	F2 connection	1P6439 X0012
	F3 connection	1P6558 X0012
	F4 connection	1P6562 X0012
2	Cage Head, steel	3N9456 22012
3	Torque Tube Arm, Steel	385317 22012
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	1B5321 25032

*Recommended spare part.

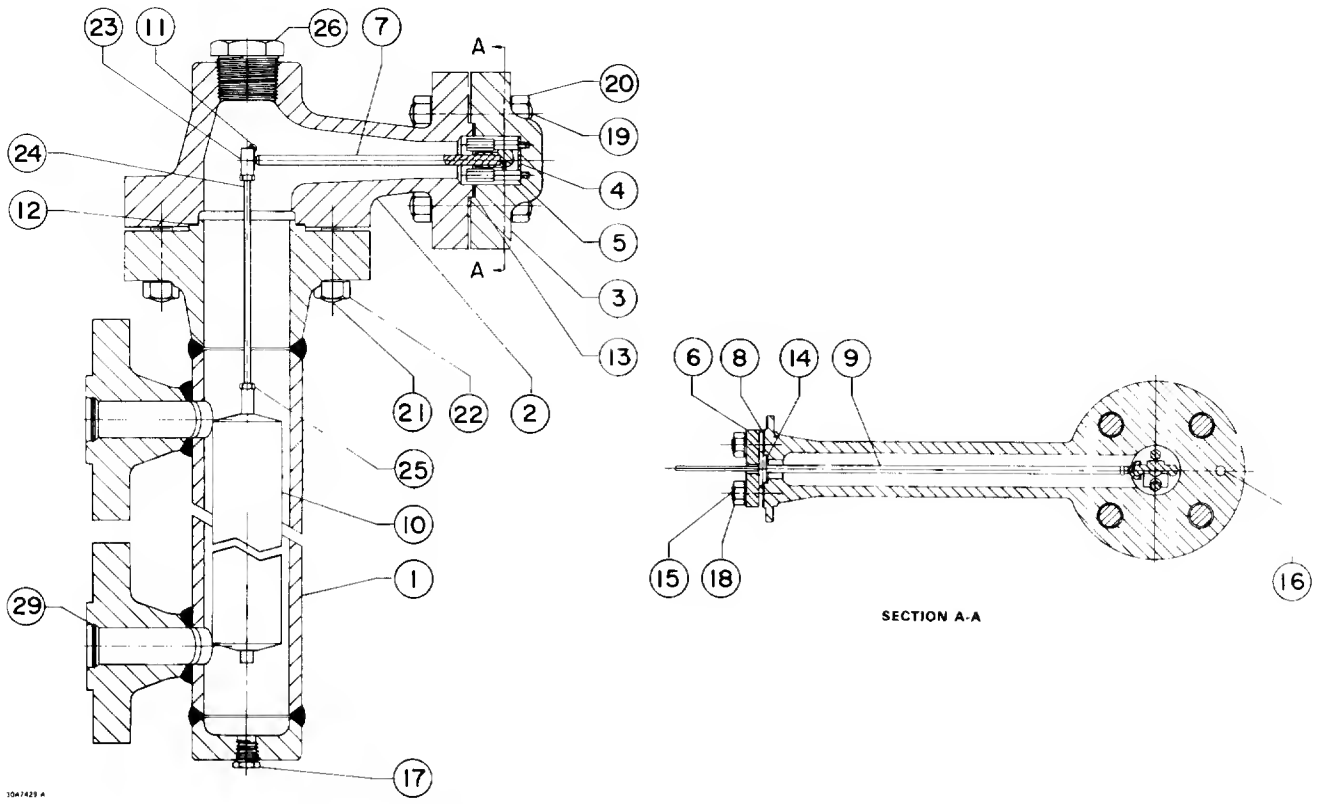


Figure 13. Type 249N Sensor Construction

Key	Description	Part Number
7	Rod & Driver Ass'y., 316 SST	185698 000A2
8	Positioning Plate, steel, Cd pl	1B8123 25082
9*	Torque Tube Ass'y., K-Monel	
	Std well	1K4499 000A2
	Thin well	1K4501 000A2
10	Displacer	
	2-3/4" x 14"	
	Solid eluminum	1P9793 09052
	316 SST	1L7548 X0012
	304 SST	1L7548 000A2
	1-13/16" x 32", Solid eluminum	1K8049 X0012
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Ring (R38), iron	1N9461 21992
13*	Ring (R23), iron	1A4455 21992
14*	Torque Tube End Gesket, 316 SST & Asbestos	1B1316 99222
15	Stud 8olt, steel (4 req'd)	1K6235 X0022
16	Groove Pin, steel, Zn pl	1A3618 28992
17	Pipe Plug (styles 2 & 3 only), Steel	1A3692 24092
18	Hex Nut, steel (4 req'd)	1A3772 24072
19	Stud Bolt, steel (4 req'd)	1A2033 31012
20	Hex Nut, steel (8 req'd)	1A4452 24072
21	Bolt Stud, steel (8 req'd)	1A5010 31012
22	Hex Nut, steel (16 req'd)	1A5011 24072
23	Stem End Piece, 316 SST	1A3933 35072
24	Displacer Stem, 316 SST	
	F1 & F2 connections	1N9591 35072
	F3 & F4 connections	1P6885 35162
25	Hex Nut, 316 SST (2 req'd)	1A3915 35252
29	Liquid Damper, 316 SST	1N2088 36022
30	Blind Flange (styles 3 & 4 only), Steel	1P4753 23022
31	Ring (R18-styles 3 & 4 only), Iron	1P4769 21042
32	Stud Bolt (styles 3 & 4 only), Steel (4 req'd)	1A3657 31012
33	Hex Nut, steel (4 req'd)	1C1727 31012
54	Nameplete (not shown) 18-8 SST	23A1725 X012
55	Drive Screw (not shown) 18-8 SST (4 req'd)	1A3682 28982

Type 249N (figure 13)

Key	Description	Part Number
1	Cage, steel	
	14" displacer length	
	F1 connection, 1-1/2"	1N8024 26032
	F1 connection, 2"	1L9155 X0012
	F2 connection, 1-1/2"	1N8026 26032
	F2 connection, 2"	1L9156 26032
	F3 connection, 1-1/2"	1N8028 26032
	F3 connection, 2"	1L9157 X0012
	F4 connection, 1-1/2"	1N8030 26032
	F4 connection, 2"	1L9154 X0012
	32" displacer length	
	F1 connection, 1-1/2"	1N8025 26032
	F1 connection, 2"	1L9158 X0012
	F2 connection, 1-1/2"	1N8027 26032
	F2 connection, 2"	1L9159 X0012
	F3 connection, 1-1/2"	1N8029 26032
	F3 connection, 2"	1L9160 X0012
	F4 connection, 1-1/2"	1N8031 26032
	F4 connection, 2"	1L9161 X0012

*Recommended spare part.

Caged 249 Series & 259B

Key	Description	Part Number
2	Cage Head, steel	
	F1 & F2 connections, 1-1/2"	2N8042 22012
	F1 & F2 connections, 2"	2L9133 22012
	F3 & F4 connections, all sizes	2L9135 22012
3	Torque Tube Arm, Steel	3B5315 22012
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	185321 25032
7	Rod & Driver Ass'y., 316 SST	1C6151 000A2
8	Positioning Plate, steel, Cd pl	188123 25082
9*	Torque Tube Ass'y., K-Monel	
	Std wall	1K4499 000A2
	Thin wall	1K4501 000A2
10	Displacer, 304 SST	
	2-7/8" x 14"	1L9152 000A2
	1-29/32" x 32"	15A4581 X042
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, Asbestos	0U0365 04022
13*	Arm Gasket, Asbestos	1A1297 04022
14*	Torque Tube End Gasket, 316 SST & Asbestos	181316 99222
15	Stud Bolt, steel (4 req'd)	1K6235 X0022
16	Groove Pin, steel, Zn pl	1A3618 28992
17	Pipe Plug (styles 2 & 3 only), Steel	1A3692 24092
18	Hex Nut, steel (4 req'd)	1A3772 24072
19	Stud Bolt, steel (4 req'd)	1A3771 31012
20	Hex Nut, steel (8 req'd)	1C1727 24082
21	Bolt Stud, steel (8 req'd)	1A3657 31012
22	Hex Nut, steel (8 req'd)	1C1727 24082
23	Stem End Piece (styles 3 & 4 only), 316 SST	1A3933 35072
24	Displacer Stem (styles 3 & 4 only), 316 SST	1L9162 35072
25	Hex Nut (styles 3 & 4 only), 316 SST (2 req'd)	1A3915 35252
26	Pipe Plug (styles 3 & 4 only), Steel	1A4442 28992
29	Liquid Damper, 316 SST	1N2088 36022
54	Nameplate (not shown), 18-8 SST	23A1725 X012
55	Drive Screw (not shown), 18-8 SST (4 req'd)	1A3682 28982

Type 259B (figure 14)

Key	Description	Part Number
1	Cage, steel	See following table
3	Torque Tube Arm, Steel	3C8183 000A2
4	Driver Bearing, 316 SST	1K5395 36042
5	Driver Bearing Bolt, 316 SST (2 req'd)	1K5394 35072
6	Retaining Flange, Steel	185320 25032
7	Rod & Driver Ass'y., 316 SST	185461 000A2
8	Positioning Plate, steel, Cd pl	1B8123 25082
9*	Torque Tube Ass'y., K-Monel	
	Std wall	1K4493 000A2
	Thin wall	1K4495 000A2
	Heevy wall	1K4497 000A2
10	Displacer, 304 SST	
	3" x 14"	15A3848 X172
	2" x 32"	15A4586 X012
	1-5/8" x 48"	15A5007 X022
	1-1/2" x 60"	15A5017 X042
	1-3/8" x 72"	1C1685 000A2
	1-1/4" x 84"	15A5104 X042
11*	Cotter Spring, 316 SST (2 req'd)	1A5179 37012
12*	Cage Gasket, Asbestos	0Y0873 04022
13*	Arm Gasket, Asbestos	1E5629 04022
14*	Torque Tube End Gasket, 316 SST & Asbestos	181316 99222
15	Stud Bolt, steel (4 req'd)	1A3310 31012
16	Groove Pin, steel, Zn pl	1A3618 28992
17	Pipe Plug (styles 2 & 3 only), Steel	1A7715 28992
18	Hex Nut, steel (4 req'd)	1A3773 24072
19	Bolt Stud, steel (4 req'd)	1A3544 31012
20	Hex Nut, steel (8 req'd)	1A3760 24072
21	Bolt Stud, steel (8 req'd)	1A3543 31012
22	Hex Nut, steel (16 req'd)	1A3520 24072
28	Blind Flange, steel	
	S1 & S2 connections	
	1-1/2" NPT	1C8286 23022
	2" NPT	1C8289 23022
	All style 3 & 4 connections	1C8287 23022
28	Top Flange (F1 & F2 connections only, Steel	
	1-1/2" Cless 150	1F9662 000A2
	1-1/2" Cless 300	1F9489 000A2
	2" Class 150	1C8319 000A2
	2" Class 300	1C8321 000A2
	2" Class 600	1C8323 000A2
29	Liquid Demper, 316 SST	
	1-1/2" NPT or 1-1/2" & 2" flanged connections	1N2088 36022
	2" NPT connections	1N2089 36022
54	Nameplete (not shown), 18-8 SST	23A1724 X012
55	Drive Screw (not shown), 18-8 SST (3 req'd)	1A3682 28982

*Recommended spare part.

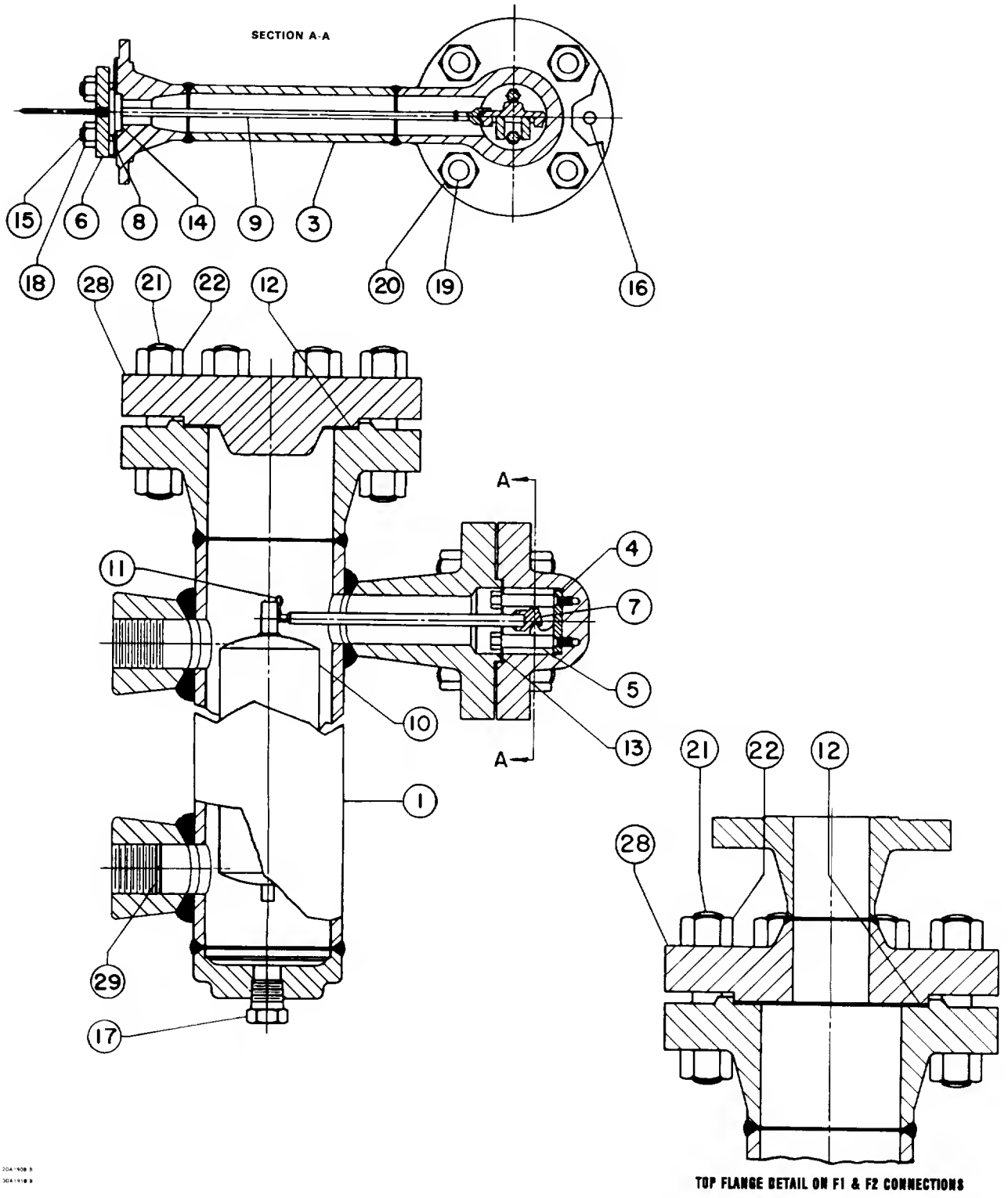


Figure 14. Type 259B Sensor Constructions

Caged 249 Series & 259B

Key 1 Type 2598 Cage, Steel

CONNECTION STYLE	SIZE AND RATING	DISPLACER LENGTH					
		14"	32"	48"	60"	72"	84"
S1	1-1/2" NPT 2" NPT	1N1804 000A2 1N1805 000A2	1N1757 000A2 1N1758 000A2	1N2038 000A2 1N2039 X0012	1N1780 26032 1N1781 000A2	1N2072 26032 1N2073 26032	1N2190 26032 1N2191 X0012
F1	1-1/2" Class 150 1-1/2" Class 300	1N2741 000A2 1L7243 26032	1L7240 000A2 1N2778 26032	1N2802 26032 1N2803 26032	1N2819 26032 1L7244 26032	1L7241 26032 1N2896 26032	1L7242 26032 1N2907 000A2
	2" Class 150 2" Class 300 2" Class 600	1N2742 000A2 1L7245 000A2 1N2745 000A2	1N2779 26032 1N2780 000A2 1N2782 26032	1N2804 000A2 1N2805 000A2 1N2806 26032	1N2820 26032 1N2821 26032 1N2822 26032	1N2897 26032 1N2898 26032 1N2899 26032	1N2908 26032 1N2909 26032 1L7246 26032
S2	1-1/2" NPT 2" NPT	1N1858 000A2 1N1859 26032	1N1766 26032 1N1767 X0012	1N2044 000A2 1N2045 26032	1N1784 26032 1N1785 X0012	1N2078 X0012 1N2079 X0012	1N2195 26032 1L7123 X0012
F2	1-1/2" Class 150 1-1/2" Class 300	1N1806 26032 1N1807 26032	1L7194 26032 1N1759 26032	1N2040 26032 1L7201 26032	1L7206 26032 1L7208 26032	1N2074 26032 1N2269 26032	1L7219 X0012 1L7221 26032
	2" Class 150 2" Class 300 2" Class 600	1N1808 26032 1N1809 000A2 1N1855 26032	1N1760 26032 1N1763 26032 1N1765 26032	1N2041 26032 1N2042 000A2 1N2043 26032	1N1782 26032 1N1783 26032 1L7212 26032	1N2075 26032 1N2076 000A2 1N2077 26032	1N2192 26032 1N2193 26032 1N2194 26032
S3	1-1/2" NPT 2" NPT	1N1869 000A2 1N1870 26032	1N1774 26032 1N1775 000A2	1N2050 X0012 1N2051 000A2	1N2140 X0012 1N2141 X0012	1N2082 26032 1N2083 X0012	1N2198 26032 1N2199 X0012
F3	1-1/2" Class 150 1-1/2" Class 300	1N1860 26032 1N1861 000A2	1N1768 26032 1N1769 26032	1N2046 26032 1N2047 26032	1L7237 26032 1N2137 26032	1L7239 26032 1L7247 26032	1L7249 26032 1L7250 26032
	2" Class 150 2" Class 300 2" Class 600	1L7235 26032 1N1864 000A2 1N1866 000A2	1L7234 26032 1N1771 26032 1N1773 26032	1L7236 26032 1N2048 000A2 1N2049 26032	1L7238 26032 1N2138 000A2 1N2139 26032	1L7248 26032 1N2080 26032 1N2081 X0012	1N2196 000A2 1N2197 26032 1L7167 26032
S4	1-1/2" NPT 2" NPT	1N2446 000A2 1N2447 000A2	1N1779 26032 1N1778 000A2	1N2052 26032 1N2053 000A2	1N2142 26032 1N2143 X0012	1N2084 26032 1N2085 X0012	1L6957 26032 1L6955 X0012
F4	1-1/2" Class 150 1-1/2" Class 300	1N2748 26032 1N2749 26032	1N2784 26032 1N2785 26032	1N2807 26032 1L7263 26032	1L7267 26032 1L7269 26032	1L7273 26032 1L7275 26032	1L7280 26032 1L7282 26032
	2" Class 150 2" Class 300 2" Class 600	1N2750 000A2 1N2753 26032 1N2754 26032	1N2786 26032 1N2787 26032 1N2789 26032	1N2808 26032 1N2809 26032 1N2810 26032	1N2823 26032 1N2824 26032 1N2825 26032	1N2900 26032 1N2901 26032 1N2902 26032	1L7284 26032 1N2910 26032 1L7287 26032